

Run plan of HPRF beam test

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Aim of this talk

- Scientific Goals for the experiment
- Beam requirements
- Instrumentation requirements (in the MTA and Linac control area)
- Radiation Assessment (format from B. Higgins & C. Johnston)
- Decommissioning plan

What can we do in beam test?

- Demonstrate HPRF under radiative condition
- Use a 400 MeV proton beam at MTA
- Time structure, characteristics, energy spread, etc of proton beam are quite different from muon beam. We need to extrapolate the experimental result (parameter) for muon beam application.
- Focus on the investigation of the RF field quality factor affected by dynamics of secondary electrons in HPRF

Why we focus on secondary electron?

- Injected beam generates a lot of secondary electrons via ionization process
- Recombination process ($H^+ + e \rightarrow H$) is expected to be very slow (order of ms) by comparing with time structure of muon beam (order of ns)
- Electrons will be accumulated in HPRF in many beam bunches
- RF power will be eaten by free electrons
- It reduces the RF field quality factor ($\sim 10^2$)
- Insufficient RF power is applied at near end of beam bunches
 - It means HPRF won't be useful
- Study dissociative process ($H_2 + e \rightarrow H^- + H$)
 - This process helps to remove electron swarm

Variables in beam test

- Beam intensity
- Gas pressure
- Gas species (+ dopant gas)
- Beam flattop time
- Electrode material dependence*
- External B field*

* Low priority for first run

Required beam parameters

- Minimum beam intensity: 5 bunches ($>10^9$ protons)
- Increase it up to permitted intensity: 100~2000 bunches ($10^{11} \sim 10^{12}$ protons)
- 5~60 shots for each intensity (assume one shot per minute during one hour for maximum intensity, but this number is flexible)
- Need decommissioning plan
- Synchronization with beam may not be an issue for first test but better to know beam coming time

Instruments

- Fast optical spectrometer
- BPM
- Logic circuit
- ACNET

To-Do-List

Assume beam time will be available within a couple of months

- Run plan (now we are on here)
- Hydrogen safety assessment
- Modify HPRF cavity
 - Add optical channel
 - May need modification to assemble at a new location
- Spectrometer (on going)
 - Calibrations (transmission efficiency, calibration of spectrometer, acceptance of system, etc)

To-Do-List (cont'd)

- BPM
 - Who is response?
 - Link to Control room? Or make it and read it by ourselves??
- Prepare other materials
 - purchase gas
 - electro-polishing copper electrodes
 - etc
- DAQ system (on going)
- Recruit

To-Do-List (cont'd)

- Simulation study
 - Collaborate with Tech-X and Voss scientific to investigate breakdown mechanism in a dense gas
 - This project will be promoted with professionals
 - It may not be bad idea to investigate breakdown mechanism by oneself
 - Someone can start developing your own code or develop XOOPIC which is free ware